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PENETRATOR ROLE IN MARS SAMPLE STRATEGY

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The application of the penetrator to a Mars Return Sample Mission (MRSM) has direct advantages to meet science objectives, and mission safety. Based upon engineering data and work currently conducted at Ball Aerospace Systems Division for Dr. William Boynton at the University of Arizona, who is the Principal Investigator on the CRAF penetrator experiment, the concept of penetrators as scientific instruments is entirely practical.

The primary utilization of a penetrator for MRSM would be to optimize the selection of the sample site location and to help in selection of the actual sample to be returned to Earth. Its recognized that the amount of sample to be returned is very limited, therefore the selection of the sample site is critical to the success of the mission. The following mission scenario is proposed to help solve this problem.

The site selection of a sample to be acquired will be performed by science working groups. A decision will be reached and a set of target priorities will be established based upon data to give geochemical, geophysical and geological data. The first task of a penetrator will be to collect data at up to 4 - 6 possible landing sites. The penetrator can include geophysical, geochemical, geological and engineering instruments to confirm that scientific data requirements at that site will be met. This in-situ near real time data, collected prior to final targeting of the lander, will insure that the sample site is both scientifically valuable and also that it is reachable within limits of the capability of the lander.

Once the penetrator verifies that both criteria are met, it can be used as a homing landing beacon for the lander. Technology for guidance of the lander to the precise sampling site is well within the state of art. After the penetrator has safely guided the lander, it could provide a navigation reference to the rover that will acquire the samples. The penetrator, with stereo capability, can obtain large scale, multispectral images to provide scientists with pinpoint location of sample sites. This mode of operation on the surface can decrease dependency upon artificial intelligence and robotic systems of the rover and therefore provide increased science payload.

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In summary, the penetrator can be an important integral part of the Mars sampling strategy by providing in-situ data, screening and confirmation data to ground based recommendations; it can act as a lander beacon for the soft landing module for pinpoint landing; and can provide a land navigation technique for the rover sample acquisition traverse. Science return will be enhanced and landing safety will be insured.